

WHAT I CLAIM IS:

1. A flexible annular surgical stapler for stapling together two parts of hollow organs, the stapler comprising –
 - (a) an elongated flexible tubular body having two ends;
 - (b) a handle attached to a first end of said body;
 - (c) a first jaw having an axial jaw hole therethrough and two faces, a first of said faces being attached to the second end of said body;
 - (d) a flexible cable slidably disposed inside said body and through said jaw hole, said cable consisting of two portions, a first of said portions defining an end segment, at least part of which protrudes from the second of said faces of said first jaw; and

(d) a second jaw, forming a head, being attachable to said end segment; said jaw hole having a non-circular cross-sectional shape and said end segment having a complementary cross-sectional shape such as to allow easy sliding of said end segment through said hole while keeping their mutual angular orientation about the axis of said hole fixed;
wherein one of said first and second jaws includes a hammer and the other of said first and second jaws includes an anvil.
2. The stapler of claim 1, wherein said head has an axial head hole, said head hole having a cross-sectional shape such as to accomodate said end segment, while keeping the mutual angular orientation of said head and said end segment about the axis of said end segment essentially fixed.

WO 98/04196

PCT/IB97/00887

3. The stapler of claim 1, wherein said end segment is stiffer than the second one of said two portions of said cable.

4. The stapler of claim 3, wherein said end segment is an extension rod, which is formed separately from said second portion of said cable and which is attached thereto.

5. The stapler of claim 1, wherein said handle includes -

(i) a housing attached to the second end of said body,

(ii) an elongated externally threaded member disposed inside said housing and attached to the second portion of said cable,

(iii) a turning assembly, which includes an internally threaded member that engages said externally threaded member, and a knob outside said housing, and

(iv) a lever assembly, which includes a manually pressable lever;

said turning assembly being operative, upon turning of the knob, to cause said cable to slide along said body; and

said lever assembly being operative to keep said turning assembly at a fixed axial position relative to said housing, when said lever is not being pressed, and to pull said turning assembly axially away from said body, when said lever is being pressed.

6. The stapler of claim 1, wherein said head is attachable to said end segment by a snap coupling.

7. The stapler of claim 6, wherein said head further includes means for detaching said head from said end segment.

8. The stapler of claim 7, wherein said means for detaching can be activated electrically.
9. The stapler of claim 7, wherein said end segment has an axial end hole therethrough and further including a guide wire attached to said head and insertable into said end hole.
10. A flexible annular surgical stapler for stapling together two parts of hollow organs, the stapler comprising -
 - (a) an elongated flexible tubular body having two ends;
 - (b) a handle attached to a first end of said body;
 - (c) a flexible cable slidably disposed inside said body having two ends, a first end being inside said handle; and
 - (d) a head attached to the second end of said cable and including an end cap; said cable having, over its entire length, a passageway therethrough for insertion of one or more additional tools or parts thereof.
11. The stapler of claim 10, wherein each of said tools is one of - an illuminator, a fibroscope, a video camera, a catheter or an ultrasonic probe.
12. The stapler of claim 10, further comprising an ultrasonic transducer for ultrasonically probing tissue near said head.
13. The stapler of claim 12, wherein said ultrasonic transducer is attachable to said head.

WO 98/04196**PCT/IB97/00887**

14. The stapler of claim 10, further comprising an illuminator for illuminating tissue near said head.

15. The stapler of claim 14, wherein said end cap is translucent and said illuminator includes a light source disposed inside said end cap.

16. The stapler of claim 14, wherein said illuminator includes an optical fiber disposed inside and along said passageway.

17. The stapler of claim 1, wherein said head further includes a translucent end cap and a light source disposed inside said end cap.

18. The stapler of claim 10, further comprising imaging optics for viewing tissue near said head, said imaging optics including a coherent fibers bundle disposed inside and along said passageway.

19. The stapler of claim 18, wherein said fibers bundle has an open end protruding from said first end of said cable, the stapler further comprising a viewing assembly, attachable to said handle so as to be optically coupled to said open end of said bundle at a constant distance therefrom.

20. The stapler of claim 10, further comprising a video camera, for viewing tissue near said head.

21. The stapler of claim 20, wherein said video camera is attachable to said head.
22. The stapler of claim 10, wherein said passageway is further operative to pass air or fluid to said end cap or to a balloon attached thereto.
23. A method for joining two parts of hollow organs over an annular area defined on a plane in each of the two parts, whereby each part has an opening through the respective plane essentially inside the respective annular area, the method sequentially comprising the steps of
-
- (a) providing a flexible annular stapler having two round jaws;
 - (b) inserting said jaws into a first one of the two parts and advancing said jaws to where one jaw is inside the first part and the other jaw is inside the second one of the two parts, each jaw being substantially near the respective plane;
 - (c) for each of the two parts, shrinking the opening so as to form an at least partially closed butt that encloses the respective one of said jaws; and
 - (d) operating said annular stapler so as to pull the two said butts together and essentially combine the two annular areas into a combined annular area, to staple the two organs or segments to each other over said combined annular area and to cut away portions of said butts that are central to said combined annular area.
24. The method of claim 23, wherein said inserting is effected through a natural opening of the patient's body.

WO 98/04196

PCT/IB97/00887

25. The method of claim 23, wherein said shrinking includes, with respect to each of the two parts, pressing the tissue surrounding the opening to form a pair of adjoining lips and stapling said lips together by means of a linear stapler.
26. The method of claim 23, wherein any of steps (b) through (d) are carried out under conditions of closed surgery.
27. The method of claim 23, wherein at least one additional surgical operation is performed between steps (a) and (d).
28. A method for joining two parts of hollow organs over an annular area defined on a plane in each of said two organs or segments, the method comprising the steps of –
 - (a) providing a flexible annular stapler having a flexible body, two round jaws and a flexible cable slidable through said body and through a first one of said jaws and having an end protrudable from said first jaw, said second one of said jaws being attachable to said end of said cable, said second jaw being initially detached;
 - (b) inserting said first one of said jaws into a first one of the two parts of hollow organs, advancing said first jaw to where it is inside the first part near the respective plane and causing said end of said cable to protrude from said first part;
 - (c) introducing said second jaw and attaching it to said end of said cable;
 - (d) having said second jaw inside the second one of the two parts of hollow organs and having each of the two parts form an at least partially closed butt at or near the respective plane, said butt enclosing the respective one of said jaws; and

WO 98/04196**PCT/IB97/00887**

(e) operating said annular stapler so as to pull said two butts together, to staple the two organs or segments to each other over the annular areas and to cut away portions of said butts that are central to the annular area.

29. The method of claim 28, wherein said inserting is effected through a natural opening of the patient's body.

30. The method of claim 28, wherein any of steps (b) through (e) are carried out under conditions of closed surgery.

31. The method of claim 28, wherein at least one of the two parts of hollow organs has an opening through its respective plane essentially inside the respective annular area, the method further comprising, for each of the two parts, the step of shrinking the opening so as to form an at least partially closed butt.

32. The method of claim 28, wherein said shrinking includes, with respect to each of the two parts, pressing the tissue surrounding the opening to form a pair of adjoining lips and stapling said lips together by means of a linear stapler.

33. The method of claim 28, further comprising, prior to step (c), the step of causing said end of said cable to protrude into the second one of the two parts of hollow organs.

34. The method of claim 28, wherein at least one surgical operation is performed between steps (a) and (e).

35. A method for joining two parts of hollow organs over an annular area defined on a plane in each of the two parts, under conditions of closed surgery performed on a patient, the method comprising the steps of –

- (a) providing a flexible annular stapler having a flexible body, two round jaws and a flexible cable slidable through said body and through a first one of said jaws and having an end protrudable from said first jaw, the first one of said jaws being attachable to said body and the second one of said jaws being attachable to said end of said cable, both of said jaws being initially detached;
- (b) inserting said flexible body through the patient's body wall;
- (c) introducing said first jaw through the patient's body wall and attaching it to said flexible body;
- (d) introducing said second jaw through the patient's body wall and attaching it to said end of said cable;
- (e) having said first jaw inside the first one, and said second jaw inside the second one, of the two parts of hollow organs and having each of the two parts form an at least partially closed butt at or near the respective plane, said butt enclosing the respective one of said jaws; and
- (f) operating said annular stapler so as to pull said two butts together, to staple the two organs or segments to each other over an annular area and to cut away portions of said butts that are central to said annular area.

36. The method of claim 35, wherein at least one of the two parts of hollow organs has an opening through its respective plane essentially inside the respective annular area, the method

WO 98/04196

PCT/IB97/00887

further comprising, for each part having an opening, the step of shrinking the opening so as to form an at least partially closed butt.

37. The method of claim ³⁵ 35, wherein said shrinking includes pressing the tissue surrounding the opening to form a pair of adjoining lips and stapling said lips together by means of a

linear stapler.

38. The method of claim 35, further comprising, prior to step (c), the step of having said flexible body protrude into one of the two parts.

39. The method of claim 35, further comprising, prior to step (d), the step of having said end of said cable protrude into one of the two parts.

40. The method of claim 35, wherein at least one surgical operation is performed between steps (a) and (f).